MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

SUPPLEMENTARY EXAMINATION

TRIMESTER 1, 2015/2016

DIM5058 – MATHEMATICAL TECHNIQUES 1

(*for diploma students only*)

18 NOV 2015
9.00 AM – 11.00 AM
(2 HOURS)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 2 pages excluding cover page and appendix.

2. Attempt ALL **FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

4. Key formulae are given in the Appendix.

Please answer ALL questions and show the necessary working steps. Each of the question is 25 marks.

Question 1

a. Simplify and express the answer in terms of positive exponents.

i. $4(2x-5y+xy-3)+3x(y+2)$ (2 marks)

ii. $\dfrac{\left(4x^3y^{\frac{5}{6}}\right)^3}{4x^{-4}y^2}$ (3 marks)

b. Rationalize and simplify the denominator, $\dfrac{2t-\sqrt{3}}{t+\sqrt{3}}$. (4 marks)

c. Solve the given equation, by factorize.

i. $16x^2-81=0$ (4 marks)

i. $x^3-5x^2=3x-15$ (5 marks)

d. Solve for x if $5\left|\dfrac{x+1}{3-x}\right|+2=27$. (7 marks)

[TOTAL 25 MARKS]

Question 2

a. Given $f(x)=4x^2-1$ and $g(x)=\dfrac{2}{2x+1}$. Find

i. $(fg)\left(\dfrac{1}{8}\right)$ (5 marks)

ii. $f^{-1}(x)$ (4 marks)

b. Given the equation of a circle is $\left(x-\dfrac{7}{2}\right)^2+(y+4)^2=6.25$

i. Find the center and radius of the circle. (2 marks)

ii. Sketch and label the circle. (4 marks)

c. Determine the quadratic function whose vertex is (-2, 3) and y-intercept is -5. (5 marks)

d. Show that $2\sin x=\dfrac{4\cos x-1}{\tan x}$ can be expressed in the form of $6\cos^2 x-\cos x-2=0$ (5 marks)

[TOTAL 25 MARKS]

Continued.....

Question 3

a. Given that $A = \begin{bmatrix} 6 & -2 \\ -4 & 1 \end{bmatrix}$ and $\boldsymbol{I}$ is the 2 x 2 identity matrix.
Prove that $\boldsymbol{A^2 = 7A + 2I}$. (5 marks)

b. Given that $C = \begin{bmatrix} 2k & -2 \\ 3 & 4 \end{bmatrix}$, where k is a real number.
Find k, if given $C^{-1} = \begin{bmatrix} \frac{2}{15} & \frac{1}{15} \\ \frac{-1}{10} & \frac{1}{5} \end{bmatrix}$. (3 marks)

c. Ahmad, John and Ravi purchased story books from the bookstore. Ahmad purchased a History and a Mystery story book for a total RM122. John purchased RM87 for a Fantasy and Mystery book. While Ravi spent RM146 for History and a Fantasy story book. The number of books purchased by the three of them are presented as follows:

Book	History	Fantasy	Mystery
Ahmad	1	0	1
John	0	1	1
Ravi	1	1	0

i. From the above information, write in the form of $\boldsymbol{AX = B}$.
[Hint: let x, y and z be the price of History, Fantasy and Mystery story book, respectively] (2 mark)

ii. By using the Cramer's Rule, find the price for each story book. (15 marks)

[TOTAL 25 MARKS]

Question 4

a. Find the sums of even integers between 9 and 35 using S_n. (3 marks)

b. The second term of a geometric series is 8 and the fifth term is -1. Find the sum of the first 6 terms. (9 marks)

c. By using Binomial Theorem, expand $(x+4)^5$. (9 marks)

d. Find the ninth term of a sequence if the first five terms are given as below:
3, 6, 12, 24, 48 (4 marks)

[TOTAL 25 MARKS]

End of Page.

Appendix:

Completing the square

$$x^2 + bx + \left(\frac{b}{2}\right)^2 = \left(x + \frac{b}{2}\right)^2$$

Quadratic formula

If $\boldsymbol{ax^2 + bx + c = 0}$ where $a \neq 0$, then

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Standard form of the equation of a circle

$(x - h)^2 + (y - k)^2 = r^2$

Standard form of a quadratic function

$f(x) = a(x - h)^2 + k,\ a \neq 0$

Trigonometric functions

$y = A \sin(Bx - C)$ or $y = A \cos(Bx - C)$

amplitude $= |A|$, period $= \frac{2\pi}{B}$, and phase shift $= \frac{C}{B}$.

Inverse of a 2 × 2 matrix

If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, then $A^{-1} = \frac{1}{ad - bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$, where $ad - bc \neq 0$.

Determinant of a 3 × 3 matrix

$$\begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix} = a_1\begin{vmatrix} b_2 & c_2 \\ b_3 & c_3 \end{vmatrix} - b_1\begin{vmatrix} a_2 & c_2 \\ a_3 & c_3 \end{vmatrix} + c_1\begin{vmatrix} a_2 & b_2 \\ a_3 & b_3 \end{vmatrix}$$

Cramer's Rule for 3 × 3 matrix

$a_1x + b_1y + c_1z = d_1$
$a_2x + b_2y + c_2z = d_2$
$a_3x + b_3y + c_3z = d_3$

then $x = \frac{D_x}{D}, y = \frac{D_y}{D}, z = \frac{D_z}{D}$ where

$$D = \begin{vmatrix} a_1 & b_1 & c_1 \\ a_2 & b_2 & c_2 \\ a_3 & b_3 & c_3 \end{vmatrix}, \quad D_x = \begin{vmatrix} d_1 & b_1 & c_1 \\ d_2 & b_2 & c_2 \\ d_3 & b_3 & c_3 \end{vmatrix}, \quad D_y = \begin{vmatrix} a_1 & d_1 & c_1 \\ a_2 & d_2 & c_2 \\ a_3 & d_3 & c_3 \end{vmatrix}, \quad D_z = \begin{vmatrix} a_1 & b_1 & d_1 \\ a_2 & b_2 & d_2 \\ a_3 & b_3 & d_3 \end{vmatrix}$$

Arithmetic sequence

$$a_n = a_1 + (n-1)d$$
$$S_n = \frac{n}{2}(a_1 + a_n)$$

Geometric sequence

$$a_n = a_1 r^{n-1}, \quad S_n = \frac{a_1(1-r^n)}{1-r}$$
$$S_\infty = \frac{a_1}{1-r}, |r| < 1$$

Binomial Theorem

$$(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k; \quad n \geq 1$$

The $(r+1)^{\text{th}}$ term in the expansion of $(a+b)^n$ is $\binom{n}{r} a^{n-r} b^r$.